Uncertain Decision Information Processing in Warning Systems under Group Decision Making Framework

A thesis submitted for the degree of
Doctor of Philosophy

By

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

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Abstract

Human factors affect the development and deployment of an effective people-centred warning system. The study of decision information processing in a complex and dynamic decision environment can be used to handle human factors efficiently.

Taking note that group decision-making is an effective processing strategy when people make decisions in a complex and dynamic decision environment, this thesis studies four aspects of decision information processing within a group decision-making framework. The four processing aspects include 1) detecting decision information inconsistency; 2) integrating decision information; 3) predicting risk using decision information; and 4) measuring decision information similarity.

Focusing on the above four processing aspects, the thesis:

(1) Presents a rule-map technique and establishes a rule-map-based information inconsistency detection method for data inconsistency; presents a state-based domain knowledge representation technique and establishes a detection method for logical inconsistency based on this;

(2) Presents an extended physical model as an information integration framework and establishes an information integration method based on this;

(3) Presents a vector aggregation operator based on a complex fuzzy set framework and establishes an information prediction method for decision information with multiple periodic features;

(4) Presents a graduate aggregation operator and establishes a measuring method for similarities among decision information.

The thesis illustrates a decision support system prototype of decision information processing in group decision-making.

Experiments indicate that the presented techniques and methods can effectively support dynamic decision information processing in a complex decision environment.

Contents

List of Tables

List of Figures